JPRS 79350

2 November 1981

East Europe Report

SCIENTIFIC AFFAIRS

No. 720

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CONTENTS

USE OF MODELLING TECHNIQUES TO SOLVE PRODUCTION PROBLEMS

Tirana ZERI I POPULLIT in Albanian 27 Sep 81 p 3

[Article: "Modelling and Some Production Problems" by Pandi Stratoberdha, director of the Laboratory for Hydraulic Research in the Academy of Sciences and Robert Progri, teacher in the Faculty of Engineering in Tirana University]

[Excerpts] Modellings in the fields of mathematics and physics have been used in Albania to find a solution to theoretical and practical problems posed by life. The partial studies executed some years ago in the "Josif Pashko" combine on thin corrugated coverings, in the Faculty of Geology on geological strata and, especially, on the enrichment of ores, in the department of inorganic chemistry of the University of Tirana on the enrichment of phosphates and other projects have paved the way for the use of these scientific methods in production and construction on a broad scale.

The great progress which Albania has made in the field of hydroenergetics has been preceded by a rapid development of hydraulic modelling activity. The Laboratory for Hydraulic Research of Tirana University, which now belongs to the Academy of Sciences, was set up in Tirana in 1969. In this laboratory, which is equipped with modern apparatus, mathematical hydraulic modelling and physical hydraulic modelling are carried out. This laboratory has contributed not only by successfully executing a number of concrete duties but also by serving as a marvelous unit for raising the scientific content and level of teaching in the discipline of hydraulics in the Faculty of Engineering.

During a period of 10 years, a number of positive studies were completed in the field of hydraulics, such as those related to the hydroelectric power plants in Vaui Dejes, Fierze, and Koman and Bushat, which are in the planning stage. In addition, a number of agricultural hydrotechnical projects were studied, such as the above-ground and underground hydraulic problems of the Cengelaj, Vlashuku, Ndroqi, and Zaranika dams and of Lumar Dam No 1.

Last year, this laboratory was concerned with the hydraulic modelling of the "Light of the Party" hydroelectric power plant in Fierze and with the problems of the hydraulic system used in the operation of this plant. Today it is also concerned with hydraulic problems related to the Koman hydroelectric power plant and the Bushat plant, the problems of tides in the ports, the problems involved in entering the port of Vlore and other important hydraulic problems. Today there are two small nucleuses of hydraulic modelling which are studying the dynamics of the underground movement of fluids. These two nucleuses have collaborated to solve important problems related

to petroleum and they provide a good example. Some studies in the area of mathematical modelling, in collaboration with the petroleum extraction sector in Fier (related to the underground problems of petroleum and aiming at the best possible use of resources) have been interesting. Nevertheless, the Hydraulic Research Laboratory should give more assistance to the other study nucleuses.

In addition to the good and important work which is being done by the centers for computer mathematics. specialized mathematical and physical models are being created in the various laboratproes and departments of the university, in the production enterprises, in construction in mechanics and in agriculture. From day to day, these models are enlarged and improved in order to better serve the building of socialism.

The resolutions of the 8th plenum of the AWP Central Committee have assigned great duties to agriculture, the extration and processing industry, the building industry and the machine industry, and, in particular, to the machine producing industry, both in regard to technology and in regard to construction. The future projects, which we will construct solely through our own forces, will require construction modelling in addition to technological modelling. In the future, these modellings will have to be expanded because they are related to the best possible construction solutions, savings in raw materials, improvements in technology and the raising of the level of mechanization of the work processes. An important role in this regard would be played by an experimental research center studying the problems of the solidity and the static and dynamic resistance of mechanical constructions and of construction. We think that the time has come to set up such a center through cooperation among the Faculty of Engineering of the University of Tirana, and the ministries of construction and industry and the Academy of Sciences. We are raising this issue because a good part of the equipment can be found in the country and there is no lack of specialists with up-to-date experience. We think that, in the beginning, studies could be made of the Mifoli railroad bridge, the reinforced concrete screen of the dam of the Koman hydroelectric power plant and other projects.

We think that the Committee for Science and Technology should play a more active role in the intensive development of modelling activity, by organizing and coordinating all scientific work in the country which is assigned to it, in cooperation with the Ministry of Education, with the other ministries and with the executive committees, so as to make modelling a scientific means in the hands of specialists in the whole country.

CSO: 2102/1

ACTIVITIES, EQUIPMENT AT ROZHEN OBSERVATORY DESCRIBED

Sofia SLAVYANI in Bulgarian 8 Sep 81 pp 69, 71

[Article by Mariya Baeva: "When the Skies Over Rozhen Are Starry"]

[Text] The National Astronomical Observatory of the Bulgarian Academy of Sciences is a small "starry" town. It is located high in the Rodopi Mountains, at an altitude of 1,750 meters. Here a 30-meter high dome raises impressively above work and residential premises. From it a telescope with a mirror 2 meters in diameter is turned to the stars.

The National Astronomical Observatory is very young: It was inaugurated at the beginning of 1981. However, its prehistory is long. BAN [Bulgarian Academy of Sciences] specialists made a thorough study of international experience in the building of such installations for 20 years. They looked for a suitable place for the Bulgarian observatory and developed new ideas in the course of such comprehensive activities. The specialists' attention was drawn to the Rozhen site. Here the number of clear nights is greater, the air is the cleanest, the elevation is sufficient and the topography and distance from settlements eliminate undesirable light radiation. The Bulgarian scientists included in the observatory the achievements of institutes, plants and specialists from the GDR, Hungary, the USSR, the United States, Great Britain, Austria and other countries. The result of these efforts is a sensitive, accurate and perfectly interacting system of modern optics, mechanics and electronics for obtaining information from the starry skies.

Today Rozhen observatory is the biggest in Southeastern Europe. Many of its features make it unique in the socialist countries. The two-meter Ritchie-Chretien telescope, fully automated, equipped with electronic technology, is the most modern big instrument ever produced at the Karl Zeiss works in Jena, GDR. Even countries such as Italy, France, the FRG and others have no such telescopes. The observatory also has a 60-centimeter telescope and a 70-centimeter Schmidt camera.

Actually, Bulgarian interest in astronomy, a science containing a pure desire for knowledge, is centuries old. The ancient Bulgarians had an astronomical calendar and the written records of the 1,300-years old Bulgarian state contain frequent references to astronomical observations and records of remarkable celestial phenomena. After 1944, Bulgaria offered extensive opportunities for the development of national observatories and planetariums. Small observatories were built, such as the one in Belogradchik (a 60-centimeter telescope) and in Stara Zagora. Stations

for watching artificial satellites were set up. The building of the National Astronomical Observatory is a major step in the development of Bulgarian astronomy.

I asked Dr Bogomil Kovachev, deputy director of the autonomous astronomy section and scientific manager of the observatory what were the tasks of the observatory.

"The problems covered by our scientific research covers some basic directions in the observation and study of stars and star clusters, galaxies and extragalactic objects, bodies in the solar system and other light-radiating objects. From Rozhen we can observe objects billions of light years away. The observatory has already obtained many plates, spectrograms and records of a number of interesting objects. We have identified 14 nova. More specifically, in the area of astrophysics, for example, spectral studies are being conducted of twin stars, magnetic stars, early and supergiants, hot stars with emission lines in the spectrum, and others. Work in this area will be based on an increasing number of comprehensive programs which will include observations conducted by other major astronomical observatories, involving the participation of leading institutes and scientists, on the basis of multilateral and bilateral scientific cooperation."

This entire complex and interesting work is being done by about 40 young specialists -- astronomers, physicists, mathematicians, engineers and technicians. They live with their families in comfortable housing facilities next to the observatory, and their working "day" begins when the sky above Rozhen is starry....

5003
CSO: 2202/1

COMPUTER SPECIALISTS DISCUSS PROGRESS, PROBLEMS

Sofia TRUD in Bulgarian 9 Sep 81 p 3

[Article by Engineer Ivan Ibrishimov: "Four Is the Lucky Number!..."]

[Text] We live in an age in which every one understands that there is no area of the country's economic life which can develop without the help of computers!....

Lines From the "Biography" of the Computers

The requirements facing computers have changed a great deal of the principles governing their manufacturing and use. Each type of economic activity has its characteristic features which require specific ways and means for the presentation and retrieval of information. This has led to the creation of dozens of different machines operating on the basis of different principles. Their mass utilization caused the problem of their universal use, interchangeability and interaction. The solution was found in the creation of computers.

The idea is that machines must consist of several units which may be combined according to needs and purposes. This is the nature of the "ES" computers adopted by CEMA (our major computer centers are equipped with modified models of such computers). Their main part is a central processor -- a system which provides the main control and data processing. Obviously, the creation and installation of such processors are among the most complex problems facing computer designers....

The Facts

The State Committee for Science and Technology presented awards to engineers Georgi Rachev, Khristina Aleksandrova, Violeta Furnadzhieva and Maksim Dimitrov, from the Computers Plant (ZIT) in Sofia for the application of the ES 2635 central processor. Why did they deserve this award?

The ES 2635 central processor is the offspring of the cooperation between the Minsk and Sofia computer institutes. It is the brain of the entire 1035 system, which includes a number of Bulgarian instruments. Series production was started in Minsk in 1979, while four Bulgarian engineers began to work on its application. In under 6 months, working night and day, in three shifts, they did a tremendous amount of rather complex work. Thus, at the cost of incredible efforts, the loss of time caused by a variety of difficulties was largely recovered.....

The People

Their average age is 30. They may have graduated from universities at different times, but are unanimous on one subject: plant practice is their great teacher. One of them, G. Rachev, is currently working at the IIT [Computers Institute], while the others have stayed with the ZIT design department. Before I meet them, I asked Engineer Todor Yonchev, the head of the department:"What was the main problem which was resolved with the help of the processor?"

"At that time we had no sufficient personnel so that we could send them to Minsk, to see the finished system on the spot. Within an exceptionally short time the four applied the processor on the basis of documentation only."

On the basis of documentation only....For a person unfamiliar with such problems this may not mean a great deal. It would be difficult even to explain how seemingly petty matters could hinder the work! Furthermore,there is virtually no case for blueprints not to have some errors or omissions. How can they be detected if there is no basis for comparison, and when, in order to go on, one needs not only knowledge and skill but intuition also? It is at such times that the individual qualities of the specialist-innovator become apparent.

Engineer M. Dimitrov: This was my first machine! I owe to it many of the things I now know. I simply did not believe that we will be successful!

Engineer Kh. Aleksandrova: It so happened that we had to do everything ourselves. Our colleagues at the IIT were quite busy with other tasks and could not help us. It order to meet the deadline we decided to work in three shifts, uninterruptedly.

Along with the application of the system, they made a number of improvements to it. The delicate operation was then taken over by the tuning shop.

Engineer V. Furnadzhieva: Compared to the application of the previous model of 1972, the difficulties involved in the application of the ES 1035 were greater. They were caused by the advantages of the new system with its double command accuracy, big memory, possibility of easy and quick correction of errors and expanded microdiagnosis. This means that the operator receives instantly precise information on any existing defect and can eliminate it quickly.

At this point, rather than enter a new area, we turn our sights to the future of the ES 1035 system. It has been in production for some time, and thanks to its universal advantages, it will be gradually replacing the current ES 1020 and ES 1022 models at the territorial computer centers. It is already being used by the Committee For Unified Social Information and by a Hungarian institute. Its qualities have placed it quite high in the hierarchy of similar systems. On its basis the IIT developed a purely Bulgarian model with even greater advantages (it is good that the main machines and assemblies are being produced in our country).

The ES 1035 will help thousands of specialists in all fields. They will welcome it as a new good machine. To those who applied it it represents something far more personal, like the figure "four," which perhaps symbolizes a very great success in innovative work!....

5003
CSO: 2202/1

REGULAR PRODUCTION OF NEW PHOTORESISTORS IN PROGRESS

Sofia VECHERNI NOVINI in Bulgarian 12 Sep 81 p 6

[Article: "Bulgarian Photoresistors: Timely Introduction of an Achievement of Our Academic Science" by Corresponding Member Professor Milko Borisov, Professor Stefan Kunev, directors of development and introduction. Candidate of Physical Sciences E. Kabasanova, Candidate of Physical Sciences R. Kakanakov, chief executors of development and introduction.]

[Text] Since July this year, the United Plants for Memory Devices (OZZU) in Plovdiv has begun the regular production of low inert photoresistors of cadmium sulfide with differential output (FRD). They are used to regulate the rewinding tension and control of magnetic tapes in memory devices, as well as to meet other needs in photoelectric automation.

This new electronic device is being developed and introduced by the Central Laboratory for Solar and Other Energy Sourses (TsLSENEI) at the Consolidated Center for physics of BAN (Bulgarian Academy of Sciences) on a contract with OZZU in Plovdiv. The basic stages in the contract were fulfilled in a year and a half.

The technology of the material for our FRD is original. It is protected by two authors' certificates for inventions. The assignment for the development of FRD was based on the parameters of the differential photoresistors manufactured by the American firm CLAREX, which were used until the present in the product CM 5300 of OZZU in Plovdiv, and upon whose import into our country an embargo was imposed. Our FRD, in comparison with the American one, is faster (its inertia is smaller than 5 milliseconds). In the present reliability experiments, which were carried for more than 3,000 hours, no failures or signs of aging were observed.

In comparison with the differential photoresistors of the type FSK-7a and FSK-7b manufactured in the USSR, our FRD's have six times higher a rate of changing their electric resistance when exposed to light. This rate is over a thousand, and in some samples it reaches hundreds of thousands. Their inertia is thirteen times smaller, and the electric current asymmetry is five times smaller. At 20 percent output, it is 20 percent, and it can be brought down to 0 percent if the output is not taken into consideration. In addition, our FRD's are two times lighter.

The production line for our FRD in OZZU in Plovdiv was made entirely in our country to designers' orders, without purchasing ready-made standard equipment. Now, with

the expansion of the production, it is being doubled and perfected in order to achieve fuller automation of the technological processes and a lower cost of the product. Presently, a metal-glass basis with an optical window is used in manufacturing FRD's. A plastic case is being developed, which is expected to lower considerably the price of the product in the future. In our country, the department for semiconductor technology and electronic materials at the higher Chemical and Technical Institute in Sofia developed and now supplies suitable initial material for the needs of this production.

In the laboratory for applied physics at ETsF (Consolidated Center for Physics) at Ban, a production section is being organized which, in the future, will begin the production of other cadmium sulfide and cadmium selenide for the needs of the photoelectric automation in our country. Annually, more than 100,000 photoresistors like these are imported for this purpose. The high quality of the Bulgarian photo-resistors makes them not only sufficient for our needs, but also competitive for export.

The good results of this development and its introduction were made possible mainly by the systematic, fundamental research in the field of photoelectric phenomena and the properties of wide-zone semiconductors, which, as an old tradition in our country, has been conducted for a long time. As it was noted in the published report of the State Planning Commission: thanks to this research, the production of photoresistors of monocrystal cadmium sulphyl was mastered as early as 1961. This production, however, could not be established at home or abroad because of insufficient technology. Later, a simple and inexpensive technology developed in our country allowed the production of sinterized material (baked under pressure powder) cadmium selenide or their mixture, with very good photoelectric properties, reaching those of monocrystals. It was shown too that alpha dichrome trioxide, used as an admixture in making this material, considerably lowers the inertia and aging of the photoresistors made by it. The influence of the dichrome oxide upon the properties of recrystalized tablets was studied in detail in several scientific works which later served as a basis for a candidate's dissertation. Now, similar studies are continuing on thin layers of these semiconductor materials recrystalized through evaporation on ceramic and quartz tablets.

The comprehensive resolution of all problems related to the development and manufacturing of this new product is due to the creative cooperation between the above mentioned laboratories in Sofia and Plovdiv, as well as the department of semiconductor materials and electronic elements at the Chemical and Technical Institute in Sofia. Optical Mechanical Plant in Panagyurishte and others. The scientific team received invaluable help from the Okrug party committee in Plovdiv and the administration of United Plants for Memory Devices in the successful implementation of a Bulgarian invention.

9804
CSO: 2202/2

WOOD INDUSTRY USING ECONOMETRIC METHODS FOR MARKETING

Bucharest INDUSTRIA LEMNULUI in Romanian No 2, Apr-Jun 81 pp 97-101

[Article by Dr D. Patriche, economist P. Ghica and mathematician I. Ghica]

[Text] The broad process of development of the modern Romanian society through the goals being sought--providing a high growth rate for the national economy, social product and national income, achieving an appropriate balance between various branches and sectors of activity, more sensible placement of the production forces on the territory, more and more powerful flourishing of science, education and culture, improvement of all social relations, deepening of socialist democracy, more and more active participation of the broad masses of workers in the leadership of the units in which they work and of all social-economic life and full assertion of the human personality[1]--increases more and more the role and importance of scientific activity, placing tasks of great responsibility before the researchers. Both the researchers as well as specialists in various areas are being called on to continually broaden the area of science in order to contribute to speeding up the multilateral progress of socialist Romania.

In this context, economic research has special tasks and must contribute substantially to improving the way that objective economic laws are used conscientiously in the practical activity of the leadership and organization of social-economic life.[2]

The study of various problems of the growth in social labor productivity, superior utilization of raw materials and energy, reduction in consumption, intensive utilization of fixed assets, rise in economic efficiency and the profitability of production, particularly continued improvement in the economic-financial mechanism involve broad-scale use of progressive methods and forms of analysis and of making economic phenomena measurable.

An important contribution in this regard can be made by incorporating guidelines and methods which are well known in modern economic practice, called marketing, into the process of organizing the leadership of economic activities.

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1. "Directives of the 12th Party Congress on the Social-Economic Development of Romania in the 1981-1985 Five-Year Plan and Future Guidelines up to 1990," Political Publishers, Bucharest, 1979.

2. "Program-Directive for Scientific Research, Technological Development and Introduction of Technical Progress in the 1981-1990 Period and Main Directions up to the Year 2000," Political Publishers, Bucharest, 1979.

Marketing, which appeared from the need to solve a number of problems connected with the rational organization of the enterprise's resources, with a view to satisfying the requirements of life under conditions of maximum economic and social efficiency, treats a complex series of problems, oriented in particular toward explaining the main aspects connected with the enterprises' market policy.

An objective approach to the marketing concept in our socialist economy accompanied in its practical application by a number of well-thought-out measures can represent an important lever for improving economic activity and for satisfying consumption needs, for orienting demand in agreement with the general interests of raising society's level of civilization and optimum utilization of the resources of the national economy.

Marketing, developed within an enterprise or industrial central, concerns all their activities, contributing to a programmed mobilization of their forces. It has in mind, in the end, the organization of all the activities contributing to achieving efficient production, in accordance with the users' requirements, on scientific bases. This makes it necessary for any economic unit which adopts a market orientation in its activity to plan its marketing activities, regardless of the horizon of anticipation to which it refers, an action carried out in marketing programs.*

Marketing activity, however, does not conclude once the marketing programs are carried out, but it continues with the application, checking and periodic review of the programs established.

In this context, the application of marketing programsmeans a detailed laying out of tasks and establishing of terms for each of them, correlated in such a way as to insure the necessary continuity throughout the series of operations comprising the program. A special role also belongs to the checking which through its permanent nature seeks to carry out the actions forecast on schedule and to bring out the appearance of any new situations caused by unforeseen aspects. Checking within the marketing programs must be conceived so that it permits a periodic review of their content in order to be able to be adapted continually to new circumstances.

World economic practice in this area has outlined a number of econometric methods which offer both the opportunity for a detailing of the programs as well as for carrying out a strict check at all stages of achievement. Among them, the method of the critical line and the PERT system (Program Evolution Research Task) [sic; should be Program Evaluation and Review Technique] enjoys special attention, with both based on the theory of graphs. It also should be mentioned that both methods are based on the same principles, with the single difference being that the first operates with known lengths of time while the second operates with aleatory lengths of time. The usefulness of the two methods lies in the fact that their application insures order for the activity and discipline and efficiency in fulfilling the marketing programs.

The most important but also the most difficult part of establishing the mathematical model based on the two methods is represented by establishing the graph for the program, that is, the part of the study actually appeals to the search for order.

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* D. Patriche: "Marketing Industrial," Technical Publishers, Bucharest, 1977.

This is because the entire marketing program, according to these methods, must be represented by a graph, with whose help the criticalline is then determined. Under the conditions where the lengths of time are known, the critical line is calculated on the graph, obtaining the time it takes to carry out all the work, the intervals of variation and the so-called operational margins.

Proceeding from the fact that the marketing program represents a great number of operations which lead to fulfillment of a goal, the method of the critical line changes it into a graph of order, where the arcs represent the operations while the peaks represent the events. In case this method is applied, the lengths of time for the operations being known, becoming operational times, take certain values attached to the graph's arcs. In order to determine the graph it also is necessary to know the succession of events. Toward this end one proceeds to draw up a list of operations which then is subdivided into the function of the desired precision. The process of shaping then continues with a working analysis, the most important and often the most laborious part, an analysis whose purpose is to determine the antecedents of each operation.

In the marketing programs, their formalized structure represents the actual list of operations with their duration, which means that notation of the events can be made by E_i, where i takes the values from the large number of natural numerals in ascending order. The duration of each element is noted with di, being known and expressed in units of time, while the antecedents are established through the immediately preceding activities. Under these conditions, representation of the CPM network through the graph is carried out easily on the basis of the tabular methods which are at the basis of substantiating any graph. On the basis of these methods the calculation of the algorithms also is provided, all the complete lines are identified at the beginning from the network and then the duration of each line is calculated. The road of maximum value, within the network, is the critical line. The operations situated on the critical line represent the critical events, with the remainder of the operations becoming noncritical events.

The method of the critical line bears in mind that two terms are calculated on the basis of the CPM network for each event (i or j): the minimum term of the event (the term closest to carrying out the activity); the maximum term of the event (the term furthest admissible for carrying out the activity).

The particular terms may be determined on the basis of many procedures. The practical algorithm, through its simplicity and flexibility, draws our attention in the case of graphs without circuits.* According to this procedure, the levels of the graph are determined at the beginning, then x_1 is considered a variable, representing an element of level (2); x_n, a variable representing an element of the level (n). If the graph has N + 1 levels, with the determinants proceeding from the origin of x_0, then x_0 is taken as the element of level (0) and x_n as the element of the level (N), calculating in succession:

$$V_1(x_1) = \max. \; v_{01}(x_0x_1) - v_{01}(x_0x_1)$$

$$V_2(x_2) = \max. \; [[\underset{x_1}{\text{MAX}}[v_1(x_1) + v_{12}(x_1x_2)], [v_{02}(x_0x_2)]\,]]$$

$$V_3(x_3) = \max.[[\underset{x_2}{\text{MAX}}[v_2(x_2) = v_{23}(x_2x_3)], \text{MAX}[v_1(x_1)+ v_{13}(x_1x_3)], [v_{03}(x_0x_3)]\,]]$$

where $V_{ij}(x_1, x_j)$ represents the value attached to the arc (x_1, x_j).

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* A. Kaufman, G. Desbazeille, "The Method of the Critical Line," Technical Publishers, 1971.

MAX is replaced by max and MIN by min in the above formulas in order to find the minimum. The reserves are then determined.

Figure 1:

The total reserve* ($R_t = T_j - t_i - d_{ij}$) represents the time within which limit one can prolong the duration of the activity, without changing the critical line and, thus, the final term for the job, in the hypothesis that the preceding activities begin on time and those which follow end within the maximum terms.

The free reserve ($R_l = t_j - t_i - d_{ij}$) establishes a dependence between the noncritical activities, since the size of the duration of an activity by more than is necessary will delay the minimum term for beginning the following activity and, thus, will reduce the free reserve of that activity.

The intermediary reserve ($R_i = Tj - T_i - d_{ij}$), which represents the maximum interval of time by which the duration of an activity may be increased without changing the minimum term for beginning the next activity, supposing that the particular activity starts within the maximum term of its preceding phase.

Proceeding from this method for determining the algorithms, the Gantt graph may be drawn up; it finds the entire series for carrying out the jobs included in a marketing program.

With a view to testing and validating their practical usefulness, the particular methods have been used in coordinating the second marketing program within the Pipera Combine for the Industrializiation of Wood, with both offering revealing elements for specialists in outlining problems. In this material we are presenting several of the aspects offered by using the method of the critical line in checking on the flow of a marketing program for launching the Silva variety of furniture on the market.

With a view to launching the particular product, a marketing program was drawn up which by including the entire series of activities, both in the area of production as well as sales, sought to provide an efficient correlation with a view to achieving the goal sought.

The structure of the program was as follows:

The market study which had in mind establishing the strategic goals, collecting and processing the data and making the decision.

Creative activity: the designing of many products, the product analysis (selecting the most competitive version of the design).

Production activity, including: establishing the working operation line, organizing work, supply, building of the product.

Promotional activity: establishing the publicity message, selecting the publicity media, launching the publicity campaign, following up on the effects of the publicity.

Commercial activity: establishing the distribution channels, establishing the need by categories, training personnel in the sales units, supplying the units, actually commercializing the product, analyzing the sales.

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* The notations are the ones in Figure 1.

The technical-economic analysis: following up on the product's behavior with the consumer, watching the following of the product, economic analysis, new market studies, making the decision depending on the new conditions.

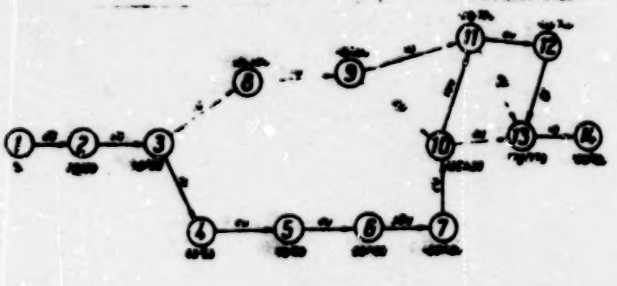
Proceeding from the particular program a list of operations was drawn up and a working analysis, as seen in Table 1, was made.

Table 1: List of Operations and Working Analysis

Activity	Event, start and finish	Description	Length of activity in days	Immediately preceding activity
1	2	3	4	5
A	1-2	Market studies	20	--
B	2-3	Creative activity	30	A
C	3-4	Production activity:		
		--establishing technological line	10	B
D	4-5	--organizing work	20	C
E	5-6	--supply with materials	20	D
F	6-7	--building the product	300	E
G	8-9	Promotional activity:		
		--selecting the medium, public, message	10	J
H	9-10	--launching publicity	20	G
I	9-11	--intermittent publicity activity	30	G
J	3-8	Commercial activity:	10	B
		--establishing the distribution channel		
		--distributing the quantities produced, training of personnel		
K	7-10	--Supplying the unit(start of sales)	20	F
L	10-11	--specialization of the product	300	H, K
M	11-12	--analysis of sales	20	I, L
N	12-13	Technical-economic analysis:	30	M
		--Seeking support for the product, following		
O	11-13	--economic analysis	20	I, L
P	10-13	--new market studies	20	H, K
R	13-14	--making a new decision	10	O, N, P

On the basis of the list of operations and working analysis the graph of the program was outlined as presented in Figure 2.

Figure 2:



Once the table of operations, working analysis and program graph were done, the move was to a calculation of the algorithms according to the methodology put forth, with the results being moved directly to the graph to the right of each node. Since it was observed that the nodes whose values are the same for the maximum and minimum terms and that they are on the critical line, no type of reserve was formulated.

Continuing, on the basis of the same methodology, the move was to calculate the reserves for the other events, the reserves in Table 2.

Table 2: Calculation of Reserves for the Events Included in the Program

1. Activitatea	2. Evenimentul început-sfîrșit	d_{ij}	t_i	T_i	t_j	T_j	R_i	R_i	R_i
A	1–2	20	0	0	20	20	0	0	0
B	2–3	30	20	20	50	50	0	0	0
C	3–4	10	50	50	60	60	0	0	0
D	4–5	20	60	60	80	80	0	0	0
E	5–6	20	80	80	100	100	0	0	0
F	6–7	300	100	100	400	400	0	0	0
G	8–9	10	50	390	60	400	340	0	0
H	9–10	20	60	400	420	420	340	0	0
I	9–11	30	60	400	720	720	630	280	280
J	3–8	10	50	50	50	380	330	—	330
K	7–10	20	400	400	420	420	0	0	0
L	10–11	300	420	420	720	720	0	0	0
M	11–12	20	720	720	740	740	0	0	0
N	12–13	30	740	740	770	770	0	0	0
O	11–13	20	720	720	770	770	30	30	30
P	10–13	70	420	420	770	770	330	330	330
R	13–14	10	780	780	—	—	—	—	—

Key:

1. Activity
2. Event--start and finish

With a view to computer processing, a system of programs was made for the Felix C-256 computer. This system of programs uses the PERT CORAIL II package, having the data from Table 1 as the entry data. The entry data were organized into a data base under administrative of the COBRA package of programs.

On the basis of the program established, the computer displays on the printout the design of the graph through a report of the critical line, which includes the prior stage, subsequent stage, name, description of the activity, whether or not it is real, duration, earliest and latest start, both for beginning the activity as well as for finishing the activity, total margin (Table 3, a copy from the printout).

In establishing the program for the computer, fixing the calendar data for beginning the marketing program (in the example given, 10 January 1979), was accompanied by the provision for not taking Sundays and legal holidays into the calculation. The computer showed the calendar dates both for beginning the activity and for ending it, with two alternatives: the earliest and the latest. The calculator also put the activities in order according to the position toward the critical line, placing first those activities which are found on the critical line, without reserves (total margin= 0), then the other noncritical ac ivities which have total reserves.

On the basis of the particular ratio of the critical line, the calculator continues to print out the results, that is, the Gantt diagram, which includes the activity (with the symbol for the start and finish above), the name and calendar by days. To the right of each activity the period of time in which this must be carried out also is placed.

Doing such a diagram offers an overall picture of the entire complex of activities as they take place on the calendar, thus being able to recognize precisely the point when any of the activities included in the program must begin and end.

Adding to the specific calendar for carrying out the marketing program in time, with a view to carrying it out under good conditions, also the advantage of a rapid calculation offered by the computer, we have the complete picture of the usefulness of the method of the critical line in providing efficient management of the activity taking place in our economic units.

Table 3: Report of the Critical Line

PERT CORAIL II
Market Forecast - S1 Network, Subnetwork 1

1. Etape Ant	2. Etape Pos	3. Nom	4. Description de l'activite		5. Duree	6. Debut tot	7. Au Plus tard	8. Fin tot	9. Au Plus tard	10. Marge totale
0	1	A	Studiu de piaţă 11.	R	20	10JAN79	10JAN79	01FEV79	01FEV79	0
1	2	B	Activitatea de creaţie 12.	R	30	02FEV79	02FEV79	08MAR79	08MAR79	0
10	11	M	Analiza vol. vînzărilor 13.	R	20	20AVR81	20AVR79	21MAI81	21MAI79	0
11	12	N	Analiza th. economică 14.	R	30	22MAI81	22MAI81	25JUN81	25JUN81	0
12	13	R	Luarea deciziei 15.	R	10	26JUN81	26JUN81	07JUL81	07JUN81	0
2	3	C	Activitate productivă, stab. liniei producţie 16.	R	10	09MAR79	09MAR79	20MAR79	20MAR79	0
3	4	D	Organizarea muncii 17.	R	20	21MAR79	21MAR79	12AVR79	12AVR79	0
4	5	E	Aprovizionare cu materiale 18.	R	20	13AVR79	13AVR79	05MAI79	05MAI79	0
5	6	F	Execuţie produs 19.	R	300	07MAI79	07MAI79	19AVR80	19AVR80	0
6	9	K	Aprovizionarea unităţii 20.	R	20	21AVR80	21AVR80	13MAI81	13MAI80	0
9	10	I	Comercializarea prod. aprovizionate 21.	R	300	14MAI80	14MAI80	28AVR81	28AVR81	0
10	12	O	Analiza economică 22.	R	20	29AVR81	03JUN81	21MAI81	25JUN81	30
2	7	J	Activitatea comercială 23. 24.	R	10	29MAR79	28MAR80	20MAR79	08AVR80	380
7	8	G	Alegeri medii publicitate, mesaj	R	10	21MAR79	09AVR80	31MAR79	13AVR80	330
8	9	H	Lansarea publicităţii 25.	R	20	02AVR79	21AVR80	24AVR79	13MAI80	380
9	12	P	Noi studii de piaţă 26.	R	20	14MAI80	03JUN81	05JUN80	25JUN81	330
8	10	L	Activitate publicitară 27.	R	30	02AVR79	25MAR81	05MAI79	28AVR81	620

Nombre de solutions 17 28.

Key:

1. Prior stage
2. Subsequent stage
3. Name
4. Description of the activity
5. Duration
6. Start
7. Latest start
8. Finish
9. Latest finish
10. Total margin
11. Market study
12. Creative activity
13. Analysis of volume of sales
14. Technical-economic analysis
15. Making the decision
16. Production activity, establishing production line
17. Organization of work
18. Supply with materials
19. Building of the product
20. Supplying the unit
21. Commercialization of the product supplied
22. Economic analysis
23. Commercial activity
24. Selecting publicity media, message
25. Launching publicity
26. New market studies
27. Publicity activity
28. Number of solutions=17

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